

Constants of Nature

(that ever physicist should know)

- **Sizes**

atom: $0.2 - 0.3 \text{ nm} = 2 - 3 \text{ \AA}$

nucleus: $\approx 10 \text{ fm} = 10^{-14} \text{ m}$

wavelength of visible light: $400 - 700 \text{ nm} = 0.4 - 0.7 \text{ }\mu\text{m}$

earth radius: $\approx 6000 \text{ km}$

- **Energies**

$1 \text{ eV} = 1.6 \times 10^{-19} \text{ Joules}$

$1 \text{ cal} \approx 4.2 \text{ J}$ (heat capacity of water $c_v = 1 \text{ cal/g/K}$)

chemical bond: $\approx 1 \text{ eV}$ or less

nuclear bond: $\approx 1 \text{ MeV}$

room temperature: $k_B T_{\text{room}} = 0.025 \text{ eV} \approx 1/40 \text{ eV}$

visible photon: $2 - 3 \text{ eV}$

solar constant (solar power per square meter striking Earth): 1000 Watt/m^2

- **Masses**

electron: $9.1 \times 10^{-31} \text{ kg} = 0.511 \text{ MeV}/c^2$

proton: $1.67 \times 10^{-27} \text{ kg} = 938 \text{ MeV}/c^2$

$m_{\text{proton}} \approx 1800 m_{\text{electron}}$

- **Densities**

water: $1 \text{ g/cm}^3 = 1000 \text{ kg/m}^3$ (cubic meter of water is a metric ton)

air: $\approx 10^{-3}$ of water

elements: $2 - 20 \text{ g/cm}^3$

- **Speeds**

sound (in air): $\approx 340 \text{ m/s}$ (1 mile per 5 seconds)

light: $3.0 \times 10^8 \text{ m/s}$

- **Pressure**

sea-level air: $14.7 \text{ psi} \approx 1.0 \times 10^5 \text{ Pascals}$ ($1 \text{ Pa} = 1 \text{ N/m}^2$)

- **Constants (SI units)**

$k_B = 1.38 \times 10^{-23}$, $N_A = 6.0 \times 10^{23}$

$e = 1.6 \times 10^{-19}$, $h = 6.6 \times 10^{-34}$

$G = 6.7 \times 10^{-11}$, $\epsilon_0 = 8.9 \times 10^{-12}$